

GEORGIA INSTITUTE OF TECHNOLOGY  
OFFICE OF CONTRACT ADMINISTRATION  
SPONSORED PROJECT INITIATION

*GOB*

Date: April 8, 1976

Project Title: "Attitudes and Behavior Change in Electrical Energy Consumption."

Project No: G-42-502

Project Director: Dr. C. Michael York

Sponsor: National Science Foundation

Agreement Period: From 3/17/76 Until 1/31/77

Type Agreement: Grant No. SMI76-08121

Amount: \$10,650

Reports Required: Final Report

Sponsor Contact Person (s):

Technical Matters

Contractual Matters  
(thru OCA)

Mr. Gaylord L. Ellis  
Grants Officer  
National Science Foundation  
Washington, D.C. 20550  
(202) 632-5965

Defense Priority Rating:

Assigned to: Psychology (School/Laboratory)

COPIES TO:

Project Director  
Division Chief (EES)  
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Security Coordinator (OCA) ✓  
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Library, Technical Reports Section  
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Project Code (GTRI)  
Other \_\_\_\_\_

GEORGIA INSTITUTE OF TECHNOLOGY  
OFFICE OF CONTRACT ADMINISTRATION  
SPONSORED PROJECT TERMINATION

Date: 9/15/77

Project Title: *Attitudes and Behavior Change in Electrical Energy Consumption*

Project No: *G-42-502*

Project Director: *Dr. C. Michael York*

Sponsor: *National Science Foundation*

Effective Termination Date: 1/31/77 (Grant Expiration)

Clearance of Accounting Charges: by 1/31/77

Grant/Contract Closeout Actions Remaining:

☐ Final Invoice and Closing Documents

☒ Final Fiscal Report

☐ Final Report of Inventions

☐ Govt. Property Inventory & Related Certificate

☐ Classified Material Certificate

☒ Other Summary of Completed Project (NSF Form 98A) by Dr. York

Assigned to: Psychology (School/Laboratory)

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G-42-502

GEORGIA INSTITUTE OF TECHNOLOGY  
ATLANTA, GEORGIA 30332

OFFICE OF  
THE DIRECTOR OF  
FINANCIAL AFFAIRS

October 4, 1977

Division of Grants & Contracts  
National Science Foundation  
Washington, D. C. 20550

Gentlemen:

Enclosed in triplicate is the final fiscal report for Grant  
Number SMI76-08121.

If you have any questions or desire additional information,  
please let us know.

Sincerely yours,

Evan Crosby  
Associate Director of  
Financial Affairs

EC/bs

Enclosures: as stated

cc: Dr. C. M. York  
Dr. E. H. Loveland  
Mr. E. E. Renfro  
Mr. A. H. Becker ✓  
File G-42-502

C. GRANT & EXPENDITURE TOTALS	
31. Total Granted by NSF (Participant Support (10) + Total Operating Costs (30))	\$ 10,650
32. Total Expenditures Charged to Grant (10 + 30)	\$ 10,553.84
33. Unexpended Balance (31 - 32)	\$ 96.16

SIGNATURE OF BUSINESS OFFICER	TYPED OR PRINTED NAME & TITLE Evan Crosby, Assoc. Dir. of Fin. Affairs	DATE 10/3/77
SIGNATURE OF PROJECT DIRECTOR	TYPED OR PRINTED NAME Kathryn A. Chandler	DATE 9/29/77

FOR NSF USE ONLY  
Final Fiscal Report Accepted

Grant Closed \_\_\_\_\_ Remains Open \_\_\_\_\_

By \_\_\_\_\_ Date \_\_\_\_\_

Grants Administration Section, Area \_\_\_\_\_

Organ. Code	F.Y.	Fund ID	Prog. Code	Ob. Class	O/Dres.	Award No.	Amd.	Inst. Code	Unexpended Balance	Trans.	Lot
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ATTITUDES AND BEHAVIOR CHANGE  
IN ELECTRICAL ENERGY CONSUMPTION

A Student-Originated Study  
Grant SMI76-08121  
National Science Foundation

Conducted By The  
Energy Use Research Team  
School of Psychology

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Richard John  
Steve Johnson  
Michael Keenan

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April 1977

ATTITUDES AND BEHAVIOR CHANGE  
IN ELECTRICAL ENERGY CONSUMPTION

Abstract of a Field Experiment

Electrical energy comprises a significant portion of the total energy demand. Reduction of consumer use of electricity constitutes a short-term strategy to ease demands on current energy resources until new ones can be found. Thus, the question of how to educate the consumer so as to reduce electricity usage becomes important. A series of Social Psychological studies, of which this study is but an initial phase, is needed to gain a better understanding of how to alter effectively the consumer's use of electrical energy. An experimental approach was chosen so as to identify potent variables which determine energy use behavior and related attitudes.

The objective of the present study was to assess the effects of three different types of communications (an emotional appeal, a rational appeal, and factual information) on behavior, observed as kilowatt hours (KWH) of electricity consumed, and attitude toward "energy conservation" and "electrical energy conservation," as measured by two Likert-type attitude scales. The study focuses on adult female residents of single-family homes in Atlanta. The rationale for initial study of women only was the intuitive understanding that women constitute the primary users of electricity in the home.

Three standardized messages were developed from similar electricity use information. Focal attention was given to practical household information as well as United States energy resources and demands. The experimenters hoped that the housewife would see herself as maintaining a place in the overall energy use of the United States. The factual information communication was constructed from resource materials obtained from the U.S. Federal Energy

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Student Originated Study, The National Science Foundation

Student Participants

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Sandra Armistead  
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Administration, the electric utility industry, the General Electric Company, and the Georgia Energy Office. The factual information treatment listed available facts relating to electrical energy consumption in no apparent order of importance. No conclusions were drawn from the facts, and no direct appeal for conservation was made. The rational appeal presented the facts in a logically deduced argumentative form which drew conclusions for the reader concerning electrical energy conservation. The emotional appeal personalized the same facts in terms of the subject's family and lifestyle.

The experimental treatments had differential effects on immediate behavior responses. Subjects given a rational appeal responded positively (conservative behavior), whereas subjects exposed to factual information responded negatively (non-conservative behavior). Although subjects who were given an emotional appeal and those who were exposed only to an attitude survey showed positive short-term responses in comparison to the no-contact control group, the differences found were small. The type of conservation literature presented had essentially no effect on long-term electrical energy use. The non-constant weather conditions had very large effects on energy use, independent of the manipulated treatment variable.

Responses to the energy conservation attitude scale were differentially effected by the energy conservation literature presented. Individuals receiving rational appeal and factual information gave significantly more conservation-oriented responses after exposure to the treatment conditions. The emotional appeal group and control group indicated virtually no change in responses to the energy conservation attitude scale. No systematic treatment effect may be concluded for the responses to the electrical energy conservation scale.

The results of this exploratory field experiment began to answer questions relevant to the topic of behavior and attitude change in energy conservation. Further research should investigate longitudinally more potent treatments which are aimed at a family or community group as opposed to the single influence attempt on only the housewife. Different situational variables (e.g., seasons, residence characteristics) should be studied due to the influences of weather on energy consumption. More subtle variations of a rational appeal should be presented and evaluated.

December 1976

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## Part 1. INTRODUCTION

### Chapter 1. Background for the Present Study

Electrical energy comprises a significant portion of the total energy demand. Reduction of consumer use of electricity constitutes a short-term national strategy to ease demands on current energy resources until new alternatives can be developed.

For decades, technical specialists and other voices have sounded realistic warnings about the electrical energy problem. The American public has been slow to respond, if at all, to these statements of concern. Only in 1977 has the President attempted to increase public awareness concerning energy limitations and the requisite behavior change among individuals--at home, at work, and in leisure activity. Thus, the question of how to communicate and literally persuade the consumer to reduce electricity usage has now become a policy issue of national import.

Behavioral science research on topics such as communication, persuasion, and social influence should be applicable to the electrical energy problem. Research in other settings suggests that the success of an influence communication is dependent on the nature and tone of the communication and the characteristics of the intended audience. Another factor of importance is the particular issue of concern. The same audience may respond to one type of communication on one issue and not respond to a similar type of communication on another issue. Unfortunately, little research of this type has been directed toward the issue of electrical energy conservation.



## Chapter 2. The Present Study

The present study proposes to be a starting point for a body of research concerned with those communication factors important to the reduction of electrical energy consumption. Its focus is the residential consumer as it has become increasingly apparent that energy conservation can and should begin in the home.

## Chapter 2. The Present Study

Objective. The objective of the present study is to assess the effects of three different types of communication, an emotional appeal, a rational appeal, and factual information on subsequent energy-related attitudes, as measured by the Electrical Energy Conservation Scale and the Energy Conservation Scale, and on behavior, in terms of kilowatt-hours of electricity consumed.

Population of Interest. The study focuses on the adult female resident of single-family homes in Atlanta, Georgia. When an attempt was made to limit the study to "middle-class" residences, this criterion was not met. In an initial contact with potential subjects, a qualifying prerequisite of household income was \$5,000-\$35,000. Even though subjects initially acknowledged that they met these criteria, written responses to questions of income suggested that the sample included a broader spectrum of incomes.

The size of the population sampled was chosen primarily for its feasibility. The study is limited to the city of Atlanta, a representative urban area. The rationale for initial study of women only is the intuitive notion that women are the primary users of electricity in the home. The attempt to obtain a sample of "middle class" residences only was based on sample size considerations. It was felt that more meaningful analyses could be performed if limitations were placed on household income. The range of \$5,000 to

\$35,000 was chosen since it includes such a large proportion of heavy energy consumers. According to 1970 census figures, the median of family incomes in the city of Atlanta fell between \$8,000 and \$9,000 and the mean family income was approximately \$10,500. The census information also suggested that twenty-seven percent of Atlanta residents have an income of less than \$5,000. However, the qualifying criterion of single-family home precluded the majority of those residents having household income of less than \$5,000. The single-family home was chosen since behavioral data (KWH) would be more readily obtained from these residences. The study was also limited to those individuals responsible for their own electric bill.

Overall Research Design. The basic design of this field experiment is schematically presented in Table 1.

Major Hypotheses. It was hypothesized that the experimental treatment conditions (i.e., variation in persuasive communication) would influence residential electrical energy use (KWH consumed) and energy-related attitudes. It was predicted that the female audience exposed to Treatment Conditions I, II and III would use less electricity and would express more favorable attitudes (on the newly developed Electrical Energy Conservation Scale and the Energy Conservation Scale) when compared with individuals in Treatment Conditions IV and V--the control groups. Specific hypotheses about the effects of a particular communication treatment were not made.

Due to the limited literature on this specific problem area, directional predictions were not made for a particular communication appeal and with respect to the personal history/demographic variables of age, education and income level, race and occupation.

Table 1

## Schematic Representation of the Research Design

Conditions	First Data Collection <sup>a</sup>	Second Data Collection	Third Data Collection	Fourth Data Collection
I. Emotional Appeal	KWH	*KWH Attitude Scales Influence Attempt	KWH	*KWH Attitude Scales
II. Rational Appeal	KWH	*KWH Attitude Scales Influence Attempt	KWH	*KWH Attitude Scales
III. Factual Information	KWH	*KWH Attitude Scales Influence Attempt	KWH	*KWH Attitude Scales
IV. Control: Attitude Scales Only	KWH	*KWH Attitude Scales	KWH	*KWH Attitude Scales
V. Control	KWH	KWH	KWH	*KWH Attitude Scales

<sup>a</sup> The first second, third and fourth data collection periods were June 29-July 8, July 14-22, July 28-August 5 and August 11-19, respectively.

\* Personal contact by research staff preceeded the data collection.

## Part 2. PROCEDURES AND METHODS

### Chapter 1. Sampling Design and Subject Variables

Subject Solicitation. The six student research investigators contacted the potential participants. They used a rehearsed format, introducing themselves to the "lady of the house" as being members of an Energy Use Research Team from Georgia Tech interested in summer patterns of energy use in "typical" Atlanta homes.<sup>1</sup> If the contact person affirmed the qualifying criteria, the housewife's responsibility within the study was explained in more detail. The explanations varied due to differential requirements in each condition. During the telephone exchange, the researchers assigned subjects systematically to one of three groups: Conditions I-III, Condition IV, or Condition V. Those who agreed to participate were then asked about vacation plans (individuals planning to be out of the home no more than five consecutive days during the 8 week period of interest were accepted.) The experimental subjects were then told that someone would be out to read their meter within the next few days. Additional information regarding meter location, best times to call, and so forth, was also recorded.

The original list of residents to contact was obtained through systematic sampling from the Atlanta City Directory (1975 Edition). The sampling procedure was such that the first single-family home

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<sup>1</sup>A "typical" Atlanta home was defined as a single-family home, responsible for payment of utilities, having a household income of between \$5,000 and \$35,000.

resident (with phone number) in the second and fourth columns of each of the 487 pages of the directory were chosen. This process was repeated using different columns, starting from the bottom of columns, and so forth, until 1349 names were drawn.

Contact attempts were directed, over a 6-day period to each of the 3149 potential subjects. Forty-nine percent (658) were not reached due to phone out of use, no answer or continuous busy signals. In attempts to each operative number six hundred ninety one residences were contacted. Of these, 145 (21%) did not meet the qualifying criteria (e.g., income too high or too low), 136 (20% agreed to participate, and 410 (59% did not express interest in participating. Of the contacts who met the criteria (N=546) 25% agreed to participate and 75% declined.

When the data collection began on June 29, 1976, 136 women were assigned as experimental subjects. Exclusion of 29 persons occurred later. Three did not live in single-family homes, one lived outside the city limits, three changed their minds about participating, one moved, one became ill, 14 reported being out of the home for more than five days, five in Condition V unable to schedule the data collection appointments, and one because of inconsistent meter readings.

Complete data were available on 100 urban housewives. Several data analyses were performed on 107 usable cases.

Possible Moderator Variables. Several other variables in addition to the qualifying criteria required of everyone, were considered as influences on the major variables. The subjects were asked in a "Confidential Information Form" such information as race, age, education, and occupation. Selected characteristics of the household income, total number of people, age categories of

members, number of bedrooms, and a list of appliances used in the home.

## Chapter 2. Dependent Variables

Actual meter readings of kilowatt-hour consumption (KWH) during specific time periods served as the behavioral measure in the field experiment. Resident's conservation-related attitudes were also considered an important indicator of the experimental treatment effect.

Behavior Measure (KWH). Kilowatt-hours of electricity consumed by each household, served as one dependent variable. Investigators read the KWH registered on each meter on four occasions. The difference between one meter reading and the previous reading measures the amount of electricity used during the time period. Four meter readings allowed for the recording of three periods of energy consumption.

An attempt was made to read each meter on an exact 14-day interval.<sup>1</sup> When this guideline was not met, the KWH consumed were averaged and projected to reflect KWH used during a 14-day period.

Conservation Attitudes. Two Likert-type scales were constructed (viz. toward Energy Conservation and toward Electrical Energy Conservation). The study participants were asked to indicate the extent

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<sup>1</sup>While the majority of the electric meters were located on the outside of the house allowing easy access, a small number were located in utility sheds, fenced back-yards, or in the homes themselves. It was necessary to contact these people so that access to the meters could be attained. Several training sessions were conducted on meter reading to insure high inter-reader reliability. In most instances two investigators were present to double-check each reading. When questionable readings were obtained, investigators were immediately dispatched to re-read that meter.



of agreement-disagreement they felt toward a series of statements. The response mode for the "energy" scale was strongly disagree, disagree, neutral, agree and strongly agree--coded 1-5 and for the "electrical energy" scale was strongly disagree, moderately disagree, mildly disagree, mildly agree, moderately agree and strongly agree--coded 1-6. The order of the verbal anchors was alternated to minimize the response set dilemma in interpretation of response data. Responses to negatively worded statements were also reverse scored so that the larger weight reflected favorable attitude. The individual's total score was the sum of her ratings for the specific conservation statements.<sup>2</sup>

An item analysis was conducted for the Energy Conservation and Electrical Energy Conservation scales. Phase I consisted of administering the original versions of both scales to a sample of Atlanta housewives. Phase II involved the computation of various statistics relevant to selecting a subset of items from the original versions. Phase III consisted of choosing the items to make up the final versions of the scales based on the content of the items and the computed statistics.

Instrument refinement was based on a sample of seventy-nine Atlanta housewives who were contacted in their homes. Forty-five housewives completed the original 69-item scale concerning Energy Conservation, and thirty-four housewives completed the original

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<sup>2</sup>The original pool of conservation attitude statements was compiled by graduate students as a laboratory exercise in a Social Psychology course. Acknowledgement is extended to James Allen, Harvey Berman, Palmer Bowen, Lee Burks, Audrey Fullerton, Timothy Keeley, Barbara Kruse, Thomas Stutzman, Barney Vermillion, Richard Verzyl and John White.

56-item scale concerning Electrical Energy Conservation. No demographic data were obtained.

Various statistics were computed on the pretest results utilizing the Cyber 70 computer and an available system of statistical programs, the Statistical Package for the Social Sciences. Field-reported item complexity and expert judgment of item content reduced the number of items to forty-nine on Energy Conservation and thirty-two on Electrical Energy Conservation. One final form was constructed for each of the two scales. Pearson item vs. total correlation coefficients were then generated between each of the items and the mean scores across all items. Standard deviations were also computed for each item in the two scales. Refer to Appendices A and B.

The final attitude scales resulted from inspection of the item-total score correlations and standard deviations. Pearson correlations for the final 10-item scale for Electrical Energy Conservation ranged from .23 to .71 while the standard deviation ranged from a high of 1.13 to a low of .52. Pearson correlations ranged from .24 to .64 on the final 15-item Energy Conservation Scale whereas standard deviations ranged from 1.80 to 1.19. The difference in variability between scales is a reflection of the difference in response mode available to the subjects and not an indication that the items in one scale are better in measuring differences than those of the other scale. The pre-test version of the Energy Conservation Scale contained six response alternatives, while the Electrical Energy Conservation Scale contained five response alternatives.

### Chapter 3. Independent Variables

Development of Treatment Communications. Three standardized messages were developed from similar electrical-use information. The treatment subjects to whom the energy use communication were

given were randomly assigned to one of three groups: Condition I being the "emotional appeal"; Condition II the "rational appeal"; and Condition III the "factual information sheet" (see Appendix C, D, E.) All three appeals were in written form.

To preclude the possibility that differences in treatment groups would be due to differences in amount of information obtained from each influence communication, an attempt was made to standarize the basic information contained in each. Focal attention was given to practical household information as well as United States energy resources and demands. The intended perspective was that the housewife would see herself as maintaining a place in the overall energy use of the United States thus producing additional motivation for conservation.

The "factual information sheet" was constructed from resource materials obtained from the:

U. S. Federal Energy Administration

The Electric Utility Industry

General Electric Company

Georgia Energy Office

The "factual information sheet" listed the available facts relating to electrial energy consumption in no apparent order of importance. No conclusions were drawn from the facts, and no direct appeal for conservation was made.

The format of the "emotional" and "rational" appeals was comprised of an introduction and a conclusion focusing on the broader perspective of United States energy. The body of each was subtitled into categories of household appliances and providing practical hints on how to conserve energy with respect to that particular

appliance. The difference between the two appeals was in tone. The "rational" appeal presented the facts in a logically deduced argumentative form which drew conclusions for the reader concerning electrical energy conservation. The "emotional" appeal personalized the same facts in terms of the subject's family and lifestyle.

#### Chapter 4. Data Collection

First Data Collection. The initial field visits to subject residences were made during the second and third weeks of the project (June 29-July 8). Except for unusual cases (e.g., meter located in locked area of the residence) no personal contact was made this time. The Student Research Investigators and part-time Research Assistants simply read the meter and left the "Confidential Information Form" in the subject's mailboxes (Condition I-IV), requesting that subjects complete this form prior to our second visit. The subject in Condition V did not receive the form on this visit as it was thought that they would have difficulty holding onto it for the 8-week period. Condition V subjects received a one-paragraph printed form telling them of our meter reading visit and thanking them for participation.

Second Data Collection. Subjects in Condition I-IV were contacted by telephone to schedule the second field visit which was made during the fourth and fifth weeks of the project (July 14-July 22). Attempts were made to schedule appointments on the fourteenth day following the previous reading. When this was impossible, two trips were made to the home: one for the fourteen-day meter reading and another for the appointment at which time another reading was taken. The appointment-day reading marked the beginning of the second fourteen-day consumption period.

Subjects in Conditions I-IV were first asked for their completed "Confidential Information Form." This was re-administered if the subject had misplaced the form. Questions about the form were answered and a double-check was made to assure that all items were completed. Special attention was given to two key items: number of people in the household and electrical appliances in use.

The attitude scales were then given to the subject. If the individual hesitated about being able to read the form or if she admitted that she could not read, the investigator read the instructions and items aloud to the subject. For subjects in Conditions I-III, a bogus item was added to the final attitude form to insure that she did read the communication. The item was as follows: "Do you feel that this information will be of value to you in your everyday living?" The communication was left with the subject with instructions that she should share it with her family and keep it for personal reference.

Condition V subjects received no personal contact on this visit. Their meters were simply read on the appropriate days.

Third Data Collection. In all conditions the subject's electric meters were read and recorded during weeks 6 and 7 of the project (July 28-August 5). Personal contact was kept to a minimum.

Fourth Data Collection. A telephone contact was made to schedule appointments with all subjects in all conditions for the final data collection during week 8 and 9 (August 11-August 19). A rearranged version of the same attitude scales was administered to subjects assigned to all five conditions. Subjects in Condition V were then asked to complete the "Confidential Information Form" completed by others earlier in the project. All subjects were

administered the "Follow-up Information Form" verbally. Each participating housewife also received a debriefing letter which described the true nature of the experiment.

Again, meters were read on all residences at the end of the 14-day period. This often necessitated two trips to a particular residence.



### PART 3. RESULTS

#### Chapter 1. Dependent Variables: Changes in Behavior and Attitude

The behavior change data consisted of three direct measures (metered KWH after the first, second and third 2-week observation period), a short-term index of consumption (Period-2 minus Period-1 usage) and long-term KWH usage (the Period-3 reading subtracted from the Period-1 consumption). Table 2 gives these descriptive data in terms of means, standard deviations and KWH range for each variable.

Table 2  
Descriptive Statistics for the Five Behavioral Variables

Response Measures	Mean KWH	Standard Deviation	Range of Consumption
Period-1	430	278	78 to 1560
Period-2	490	359	90 to 2378
Period-3	415	270	87 to 1728
Two-Week Index	60	142	-404 to 818
Four-Week Index	-15	111	-427 to 260

Overall electrical energy use, in the households sampled, increased during the second period then decreased slightly below the baseline KWH reading. The variability was correspondingly higher for the second two-week period of observation.

These consumption data-for July and August-follow the weather pattern, as portrayed in Table 3. Note how the rise (for Period-2) and fall (during Period-3) in electricity usage parallels the weather

observations (mean temperature, number of "cooling days," and average humidity recorded). Outdoor temperature on summer days is an apparent

Table 3

Weather Observations During the Field Experiment on Energy Use

Two-week Periods	Actual Dates	Mean Degrees Fahrenheit	Cooling Days	Average Humidity
1	7/6 - 19	76.00	11.00	74.71
2	7/20-8/2	79.14	14.14	75.93
3	8/3 - 16	75.57	10.57	71.50

predictor of increased reliance on air-conditioning which enhances energy use. A significantly greater use of electrical energy was confirmed for the homes with central air-conditioning ( $F_{1,97} = 21.6$   $p < .001$ ), utilizing the two-week index of KWH usage.

The influence of the rational, emotional and factual communication appeals on change in metered KWH was tested by means of an analysis of variance model. Using the two-week index as the dependent variable, the demographic variables of consumer age, race, occupation, education and household's income-level were tested separately<sup>1</sup>--treating the appliance saturation of that home as a covariate.<sup>2</sup>

<sup>1</sup>The analyses were restricted to the 2-factor model due to limitations of sample size in this first study.

<sup>2</sup>Appliance data were obtained in the biographical questionnaire. The differential weighting system produced a variable ranging from zero to 2137 points.

Figure 1 shows a difference between the appeal groups ( $p < .05$ ) when that variable is analyzed in a one-way covariance design (i.e., disregarding the demographic variables). Despite the increases observed for all groups in the second two-week period (after exposure to energy conservation literature), considerable differences among groups are evident. The rational appeal group increased considerably less and the factual information group increased much more than did the emotional appeal and the two control groups which clustered together in the second two-week period.

However, when the various randomized blocks covariance analyses, summarized in Table 4, are examined, the appeal variable has an effect with probability value less than .05 only when evaluated in conjunction with the education variable. Furthermore, the only analysis showing a blocking variable by appeal interaction is that using age as blocks. In that case, the interaction has probability value less than .01 and both main effects have values greater than .05. These results question the implications about differences among the levels of the independent variable (appeal) which are apparent in Figure 1. Figures 2 through 5 present histograms for those blocking variables in Table 4 reflecting probability values less than .05.

In addition to the expected finding that consumption was associated with income level, Figure 2 indicates that high income families (over \$25,000) vary more over time in their energy use behavior than do low income families.

Average plots in Figure 3 show clearly that Negroes used much less energy than the Caucasians and that Caucasians varied considerably more over time than did Negroes in the amount of electricity used. Figure 4 strongly suggests that the less educated women use less electricity than is the case for the educated women and that

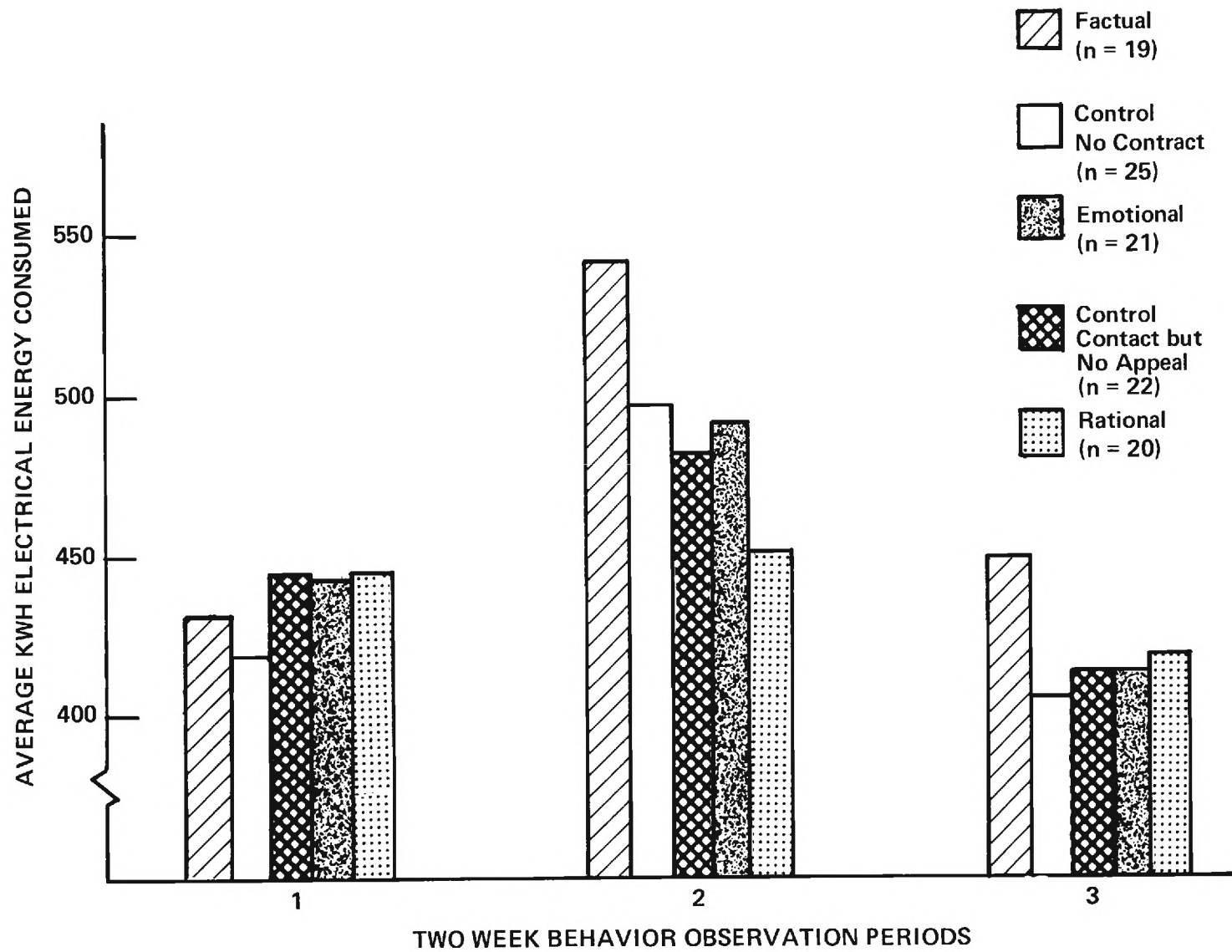


Figure 1. Average KWH and Communication Approach.

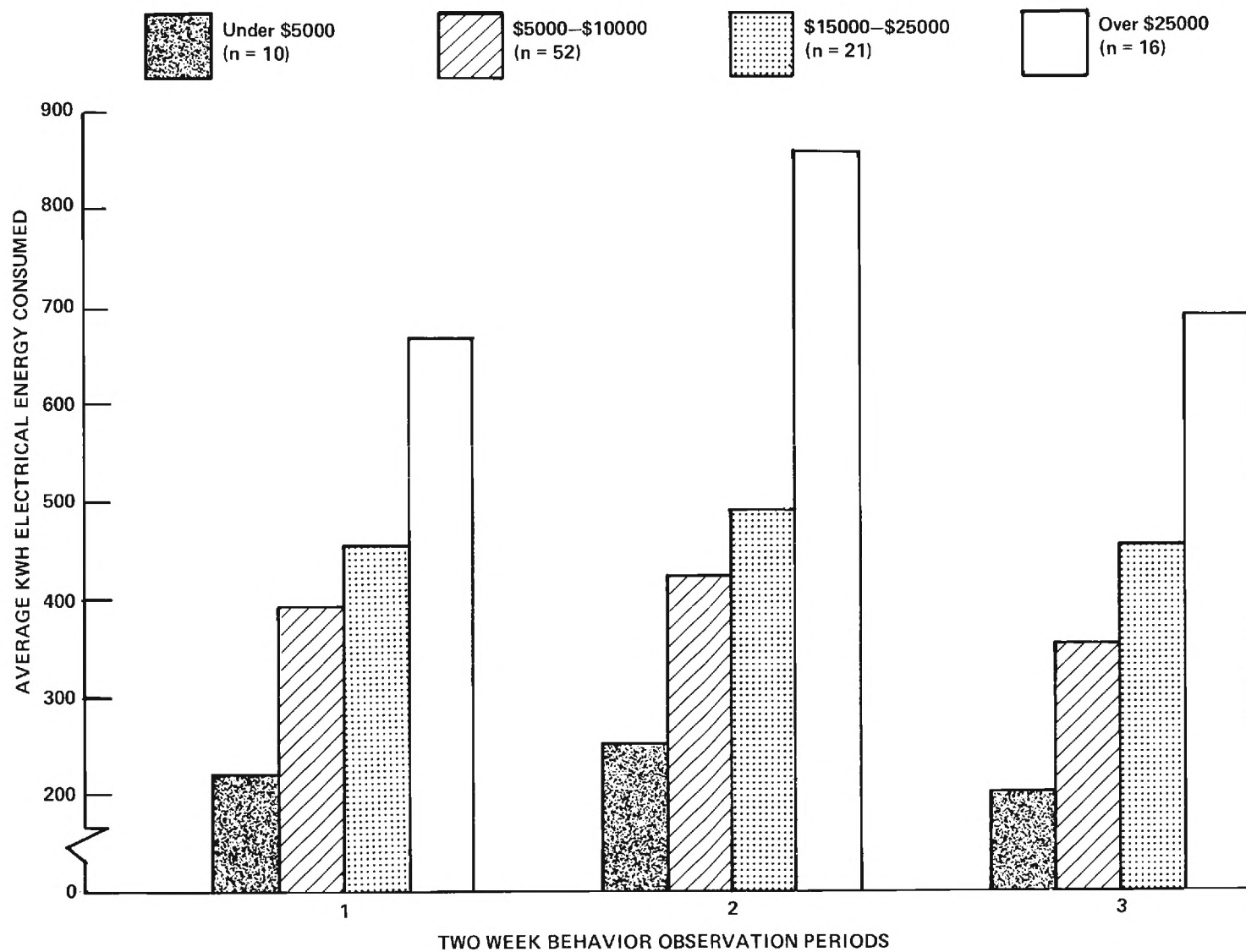


Figure 2. Average KWH Used by Income Level for Each Period Observed.

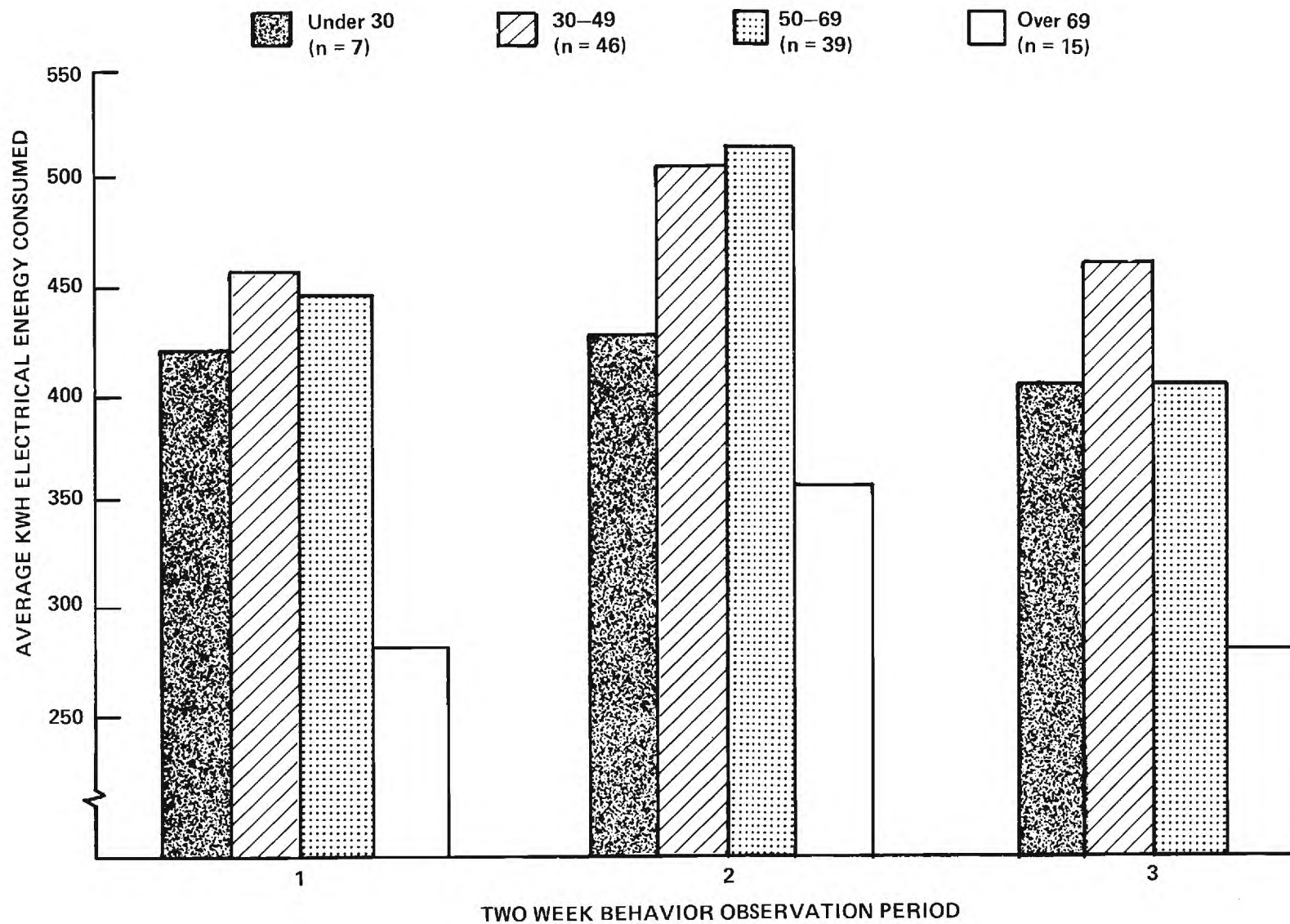


Figure 3. Average KWH Used by Age Category for Each Period Observed.



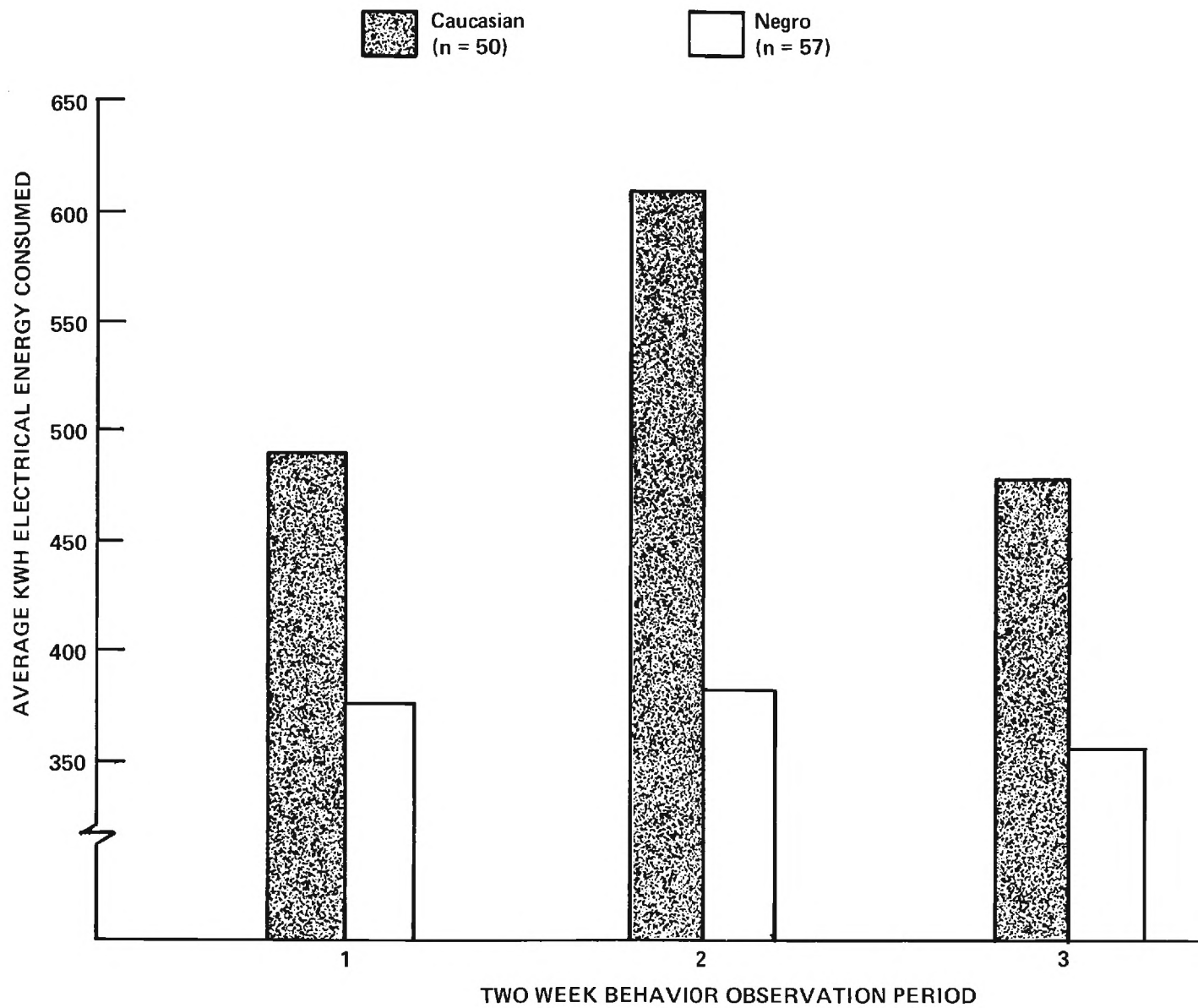


Figure 4. Average KWH Used by Race for Each Period Observed.

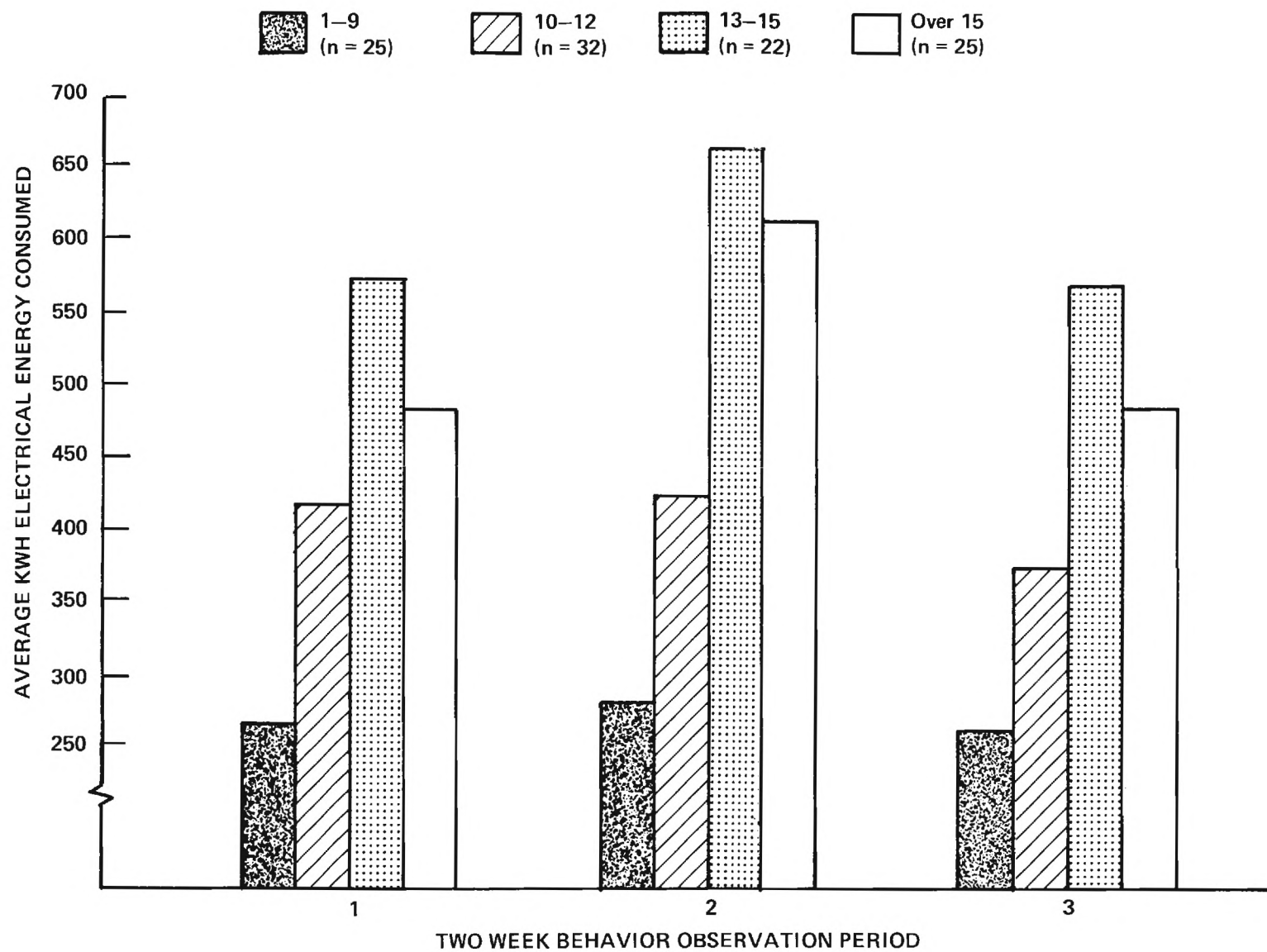


Figure 5. Average KWH Used by Education for Each Period Observed.

TABLE 4  
Summary of the Various Randomized  
Blocks Covariance Analyses

Analysis with Blocking Variable (df)	Error df	P-values	
		Blocking Variable	Appeal Variable (on 4 df)
Age (3)	12*	>.10	<.08
Race (1)	97	<.005	<.06
Occupation (2)	91	<.05	<.07
Education (3)	84	<.05	<.04
Income-level (3)	79	<.01	>.10

\*The error degrees of freedom in the Age by Appeal Analysis are those for the significant interactions of that analysis. Other blocking variables with p-values greater than .05 were: Number of bedrooms and residents and hours/week absent from the home.

a larger variance in KWH consumption over time is predominant among women with education past high school. Figure 5 indicates that women employed part-time used more energy than women employed full-time, who use more energy than fulltime housewives. Women employed part-time varied much less in energy consumption over time than did women in the other two categories.

The same analysis was performed on the 4-week index of KWH usage. No significant effects were found for the appeals or other factors tested. No systematic variation in long-term behavior change was discernable from the classifications analyzed.

The availability and use of central cooling also deserved further analysis. Contingency tables were constructed between use of central air-conditioning and appeal, income, age, race, education and occupation. Higher income subjects used central air-conditioning significantly more than did lower income subjects ( $X^2 = 9.29$ ,  $p < .03$ ). Well educated subjects also used central air-conditioning significantly more than the less-educated subjects ( $X^2 = 16.60$ ,  $p < .001$ ). In addition, the percentage of Caucasians who had central air-conditioning was twice that of Negroes. No significant  $X^2$  resulted from the appeal, age or occupation data.

These findings explain a large portion of the differences in energy increases observed within categories of education, income, and race (e.g., a high income subject would perhaps increase more from the first to second two-week period because of access to energy-consuming central air-conditioners). The differences in the 2-week index found significant for income, education, and racial variables is probably a result of differential weather effects rather than an interaction with the communication appeals.

## Chapter 2. Findings for the Attitude Dependent Variables

The second phase of the analysis dealt with the attitude change data. Four direct measures of attitude were made: pre - and post-experiment energy conservation score, and pre- and post-electrical energy conservation score. Each of the four attitude scores is an average of the respective item responses (coded 1-2-3-4-5). Weights for the responses to negative items on each scale were reversed so the "5" always indicated very conservation-minded attitudes, and "1" always meant little or no regard for energy conservation.

Two derived measures of attitude change were obtained by algebraic manipulation of the direct dependent variables. Thus, EC CHANGE refers to energy conservation attitude change and EEC CHANGE represents electrical energy conservation attitude change.

The descriptive statistics for these attitude measures are given in Table 5. No significant change in attitude was recorded.

Attitude scale scores for energy and electrical energy conservation are given in Figure 6. Table 6 shows the inter-r matrix.

A one way analysis of variance was performed using the EC and EEC CHANGE data as the dependent variable and the treatment groups as the independent variable. A significant effect in the direction of conservation was found for EC CHANGE ( $F_{2,62} = 2.98, p < .04$ ), but not for EEC CHANGE ( $F_{3,62} = 1.14, p < .3$ ). The significant appeal effect on the EC difference reflect a large increase (+.37) in conservative attitude in the rational appeal group, accompanied by a smaller increase (+.12) in the factual information group. The emotional appeal and control groups remained essentially unchanged in general energy conservation attitude. No systematic trend in electrical energy attitude change is suggested by the pre- and

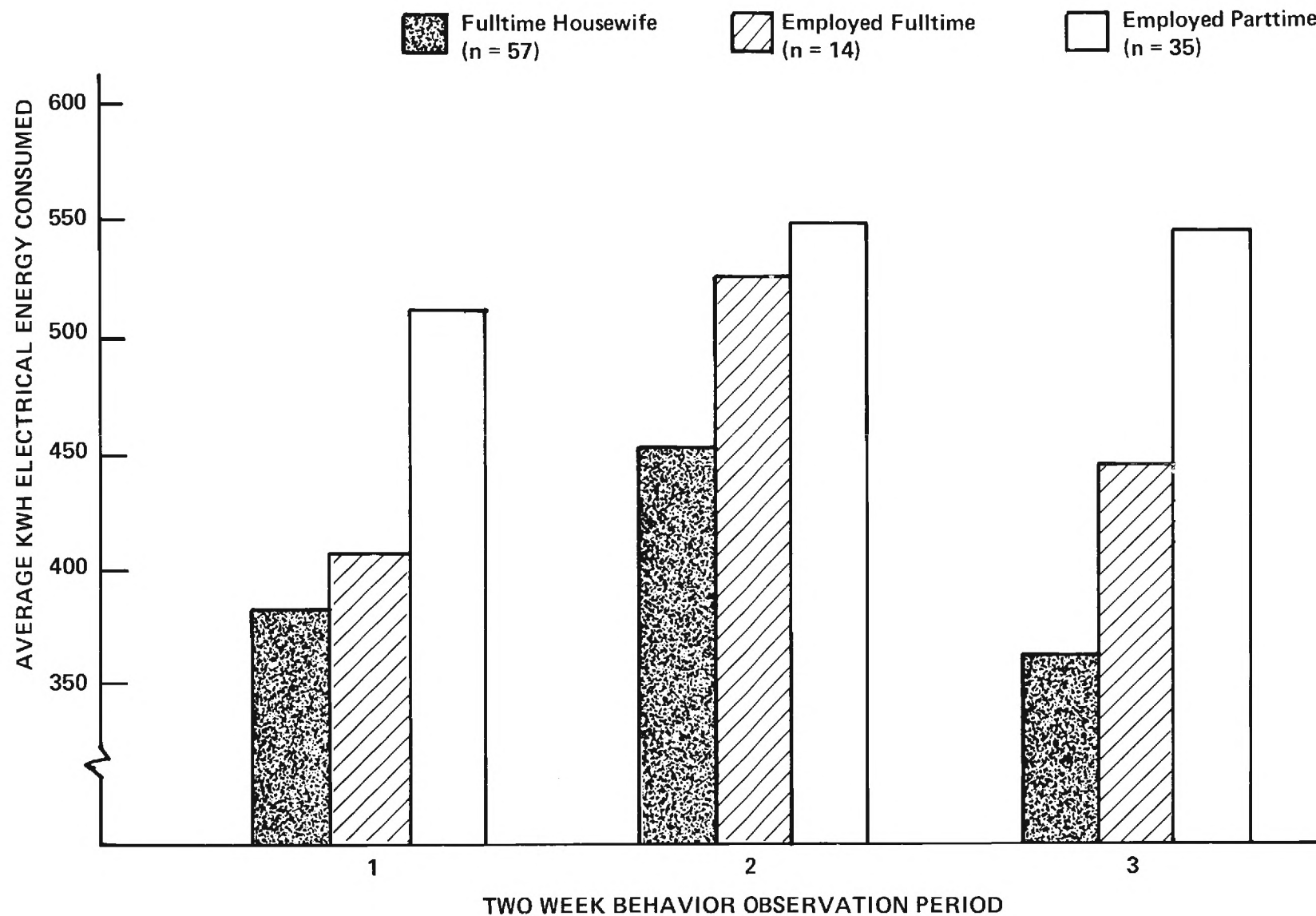


Figure 6. Average KWH Used by Occupation for Each Period Observed.

Table 5

Descriptive Statistics for the Attitude Dependent Variables

Attitude Variables	Mean Score	Standard Deviation	Range of Scores	
			Min.	Max.
EC SCOR 1	3.35	.56	2.00	4.60
EC SCOR 2	3.46	.55	2.23	4.64
EC CHANGE	.11	.42	-1.08	1.33
EEC SCOR 1	3.56	.44	2.50	4.67
EEC SCOR 2	3.52	.51	2.40	4.56
EEC CHANGE	-.06	.49	-1.23	1.05

Table 6

Relationships among the Four Attitude Scores

Scale Scores	EC1	EC2	EEC1	EEC2
EC SCOR 1		.75	.56	.70
EC SCOR 2			.45	.63
EEC SCOR 1				.52
EEC SCOR 2				



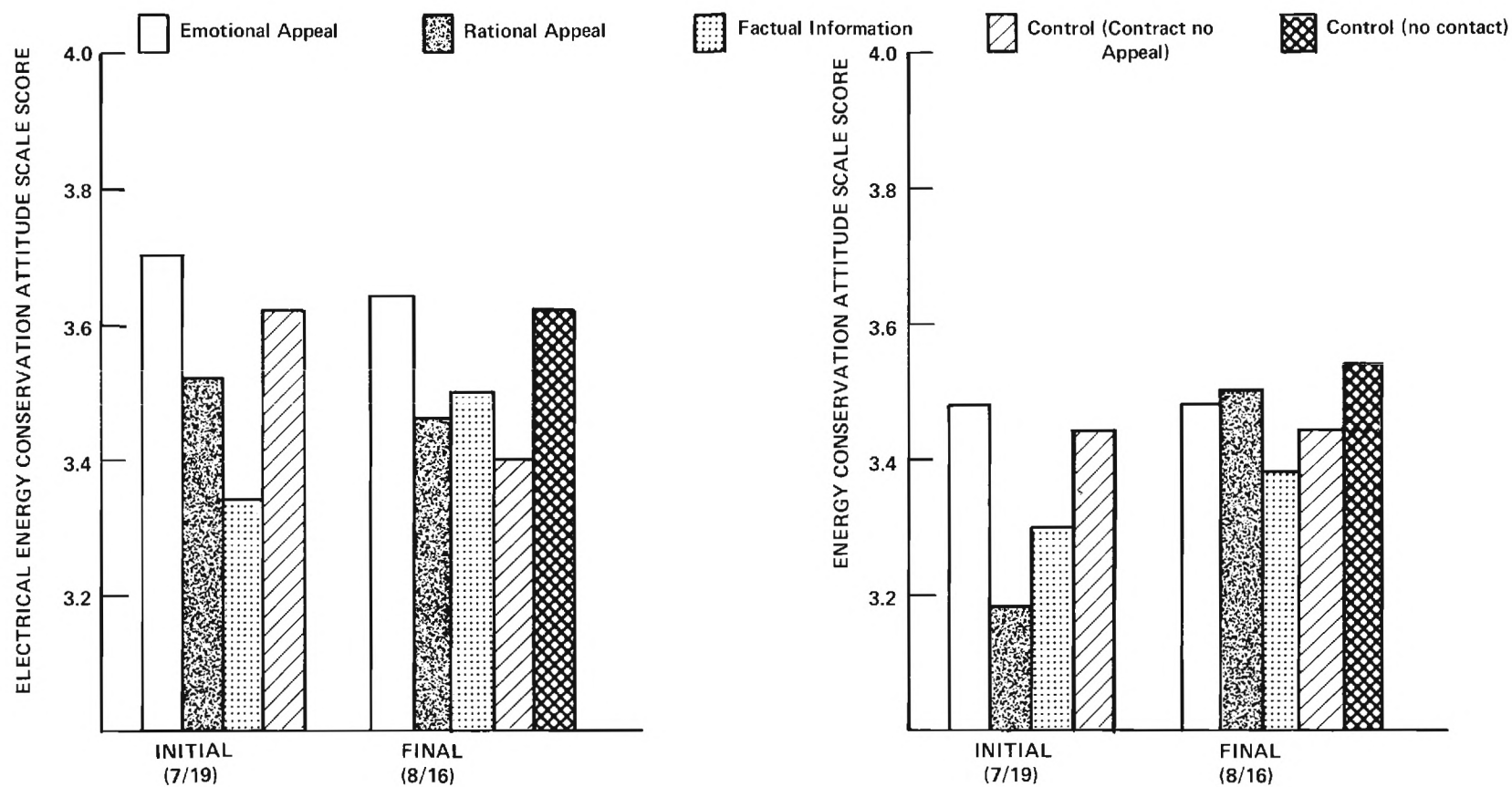


Figure 7. Conservation Attitudes by Group at Two Times.

post-treatment and control group data in Figure 1.

Several two-factor analysis of variance were constructed using the "before" and "after" score difference for the two scales as dependent variables with no covariates. Appeal was one factor in each model and one of the previously listed diagnostic classifications was the other factor. No other effects were significant other than the effects due to the appeal variable, discussed above.

The same two-factor model constructed using the inferred classifications obtained from post-experiment objective questions (also analyzed with respect to behavioral variables) did produce two interesting findings. Question-6 on the final questionnaire resulted in a classification of the housewives into three categories corresponding to a perceived increase in KWH consumption over the six-week contact period. Using EEC CHANGE as the dependent variable and appeal and perceived use as independent variables, a significant perceptual effect was discovered ( $f_{2,54}=4.50$ ,  $p<.02$ ). Subjects who responded that they had decreased in energy use showed a considerable increase in electrical energy conservation attitude (+.22), whereas those who reported a possible increase or no change became less conservative in attitudes concerning electrical energy.

Question -10 on the final questionnaire asked subjects to rate themselves on a "How conservative am I in energy use?" scale where a 10-rating would be very conservative and "1" not at all conservative.

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<sup>1</sup>Test-retest reliability is greater for the energy conservation scale ( $r=.75$ ) than the electrical energy conservation scale ( $r=.52$ ). Energy and electrical energy conservation attitudes are moderately related ( $r=.56$  before the appeals and  $r=.63$  after participant exposure to the experimental treatment conditions).

The responses were grouped to form three categories of a "conservation" variable corresponding to scores of 1-4, 5-7, and 8-10. Using EC CHANGE as the dependent variable and appeal and "conservation" as independent variables, a significant effect occurred ( $F_{2,55}=3.29$ ,  $p<.05$ ). Subjects who responded moderately (scores 5-7) had a large increase (+.23) in energy conservationist attitude, whereas subjects who responded in the 8-10 range showed very slight increases (+.08). Subjects responding in the 1-4 region showed extremely large decreases (-.23).

#### Part IV. CONCLUSIONS

In the present field experiment, the communication appeals aimed at housewives' conservation of electricity were overshadowed by personal attribute variables such as education-income level, race, and the situational impact of having and using central air-conditioning on hot summer days (the weather factor). For example, the correlated education-income variables were inversely related to energy conservative behavior. The college-educated housewives conserved kilowatt hours more than the college-exposed but not as much as those who did not attend college. The work-status of the woman was also a revealing variable (i.e., full-time housewives were most conservative, the part-time employed least conservative-- a finding probably confounded with income, race, hours-absent per week). For the three two-week periods of observation, electrical energy usage could not be explained in terms of the rational, factual, emotional, written messages. Of the three treatment conditions, factual information revealed greater influence. The brief periods of observation in this exploratory project and the aforementioned individual differences and situational influence explains in part this finding.

The weather effect clearly paralleled the consumption patterns of the present test subjects. Research is needed to document more fully the relationship of actual and perceived weather change, and its effect on home comfort and overt energy-related behaviors among residents.

The generalized conservation attitude indicated a favorable effect whereas no significant change was obtained for the specific electrical energy conservation attitude. When categorized in terms of perceived energy use and perceived energy conservation, the individual's attitude was dependent on one's self-concept. These findings suggest that the attributes of consumers deserve greater research attention than reported in the present energy-related literature. Long-term studies would also be required to obtain stable effects on behavior and attitude.

This exploratory field experiment among urban housewives has highlighted the need for comprehensive, long-term experimentation on major variables among energy users. The magnitude of national policy implications for energy reduction (and peak-load relief) argue for continued investigation of behavior patterns in the house.

ID \_\_\_\_\_

Please indicate the extent of your agreement or disagreement on each item by putting the appropriate number in the space provided.

- 1 Strongly disagree
- 2 Disagree
- 3 Neutral
- 4 Agree
- 5 Strongly agree

## ATTITUDE TOWARD ELECTRICAL ENERGY CONSERVATION

- \_\_\_\_\_ 1. The government should keep an appliance off the market if it fails to meet efficient energy use standards.
- \_\_\_\_\_ 2. It is possible for one person to conserve a significant amount of energy in his own home.
- \_\_\_\_\_ 3. I would be in favor of government imposed standards for efficient energy use.
- \_\_\_\_\_ 4. It is unrealistic to ask the average American to reduce his electrical energy consumption in day-to-day living.
- \_\_\_\_\_ 5. Power companies should make peak period power use much more expensive than power used at other times.
- \_\_\_\_\_ 6. Most houses in the United States are too warm in the winter.
- \_\_\_\_\_ 7. The so-called "energy crisis" is probably a scare tactic the power companies are using to warrant increased electric bills when actually they are increasing profits.
- \_\_\_\_\_ 8. If power rates double in the next few years, I would reduce my home use of electricity drastically.
- \_\_\_\_\_ 9. In times considered to be emergencies, rationing of electrical power may be necessary.
- \_\_\_\_\_ 10. I would not voluntarily reduce my use of electrical energy during an energy crisis.

PRE-TEST RESPONSE DATA: ELECTRICAL ENERGY CONSERVATION SCALE<sup>a</sup>

Scale Item	Content of the Statement	Mean Score	Standard Deviation
1	... ban inefficient appliances	3.8	0.8
2	... can conserve at home	3.8	1.0
3	... favor government standards	3.0	1.0
4	... unrealistic to cut usage	4.2	1.0
5	... peak period use more costly	3.2	1.1
6	... overheating in winter	4.0	0.8
7	... energy crisis a scare tactic	3.6	1.0
8	... will cut usage if costly	3.9	1.0
9	... rationing may be necessary	4.1	0.5
10	... would not voluntarily reduce	4.2	1.1

<sup>a</sup>Data from 34 adult females in Metro Atlanta.



ID \_\_\_\_\_

Please indicate the extent of your agreement or disagreement on each item by putting the appropriate number in the space provided.

- 1 Strongly disagree
- 2 Disagree
- 3 Neutral
- 4 Agree
- 5 Strongly agree

## ATTITUDE TOWARD ENERGY CONSERVATION

- \_\_\_\_\_ 1. I would not attend a free class on how to conserve energy.
- \_\_\_\_\_ 2. Gasoline companies have manufactured the energy crisis to boost earnings.
- \_\_\_\_\_ 3. I agree with the government's action of reducing the speed limit to 55 m.p.h. in order to conserve gas.
- \_\_\_\_\_ 4. I am willing to pay higher taxes to support energy conservation programs.
- \_\_\_\_\_ 5. If present trends continue, there will be no more oil within 30 years.
- \_\_\_\_\_ 6. The cost of energy sources should remain high to prohibit wasteful use.
- \_\_\_\_\_ 7. It is a good idea to allow people in car pools to have reserved parking places which are closest to their office building.
- \_\_\_\_\_ 8. It wouldn't make any difference whether I tried to save energy or not.
- \_\_\_\_\_ 9. Solar energy is not a good alternative energy source for the future.
- \_\_\_\_\_ 10. The media's coverage of the energy crisis is another instance of the press' sensationalism of the news.
- \_\_\_\_\_ 11. We owe it to future generations to have an ample supply of energy available.
- \_\_\_\_\_ 12. The public knows little about how to conserve energy and should be given information on how to do so.
- \_\_\_\_\_ 13. I would watch good television specials about energy conservation.
- \_\_\_\_\_ 14. The energy shortage has been blown out of all proportion.
- \_\_\_\_\_ 15. I believe that there is a gas shortage.

PRE-TEST RESPONSE DATA: ENERGY CONSERVATION SCALE<sup>a</sup>

Scale Item	Content of the Statement	Mean Score	Standard Deviation
1	... attend free class	4.6	1.6
2	... gas firms made crisis	3.5	1.6
3	... support for 55 mph	4.8	1.8
4	... would pay higher taxes	3.4	1.6
5	... no oil in 30 years	3.8	1.4
6	... keep energy expensive	3.4	1.5
7	... reward car pools	4.5	1.4
8	... personal apathy	5.2	1.2
9	... solar not promising	5.1	1.2
10	... media overplay the crisis	4.1	1.7
11	... supply further generations	5.0	1.5
12	... public needs information	4.8	1.4
13	... would watch TV about energy	5.2	1.2
14	... energy shortage overplayed	3.7	1.7
15	... gas shortage believed	4.1	1.5

<sup>a</sup>Data from 45 adult females in Metro Atlanta.

## Appendix C.

### ENERGY USE

What happens when you turn on your light switch? Your lights go on. But will your lights always burn brightly by the flip of a switch? Shortage of energy is a problem we Americans face. Ninety-five per cent of our fuel is taken from sources that can never be used again. We import forty per cent of our oil supply from foreign nations who, because of our nation's definite need, can control prices. One of our nation's only hopes of facing this energy problem is the conservative use of energy in our homes. A few simple efforts on the part of each American household can save energy for our country and money for our families.

#### HOT WATER HEATING IN THE HOUSEHOLD

The daily household duties depend on your efficient use of the many convenient home electrical appliances. Heating the water for your children's baths, your dishes to be washed, and your family's clothes to be cleaned takes 15% of the energy used in the home and 3% of all energy used in our country. Setting the electrical hot water heater at 140 degrees heats the water for these tasks. Because showering takes five gallons less hot water than bathing, let's teach the young children to take showers instead of playing in the tub. The turning on of the hot water tap has become an almost subconscious use of energy, and the drip of the faucet has become the rhythmic undercurrent of our homes. A leak of one drop per second of hot water adds up to 650 gallons per year. A leak that fills a cup in ten minutes uses 3280 gallons of heated water a year. Such atrocious wasting of energy can be avoided by simple repairing efforts--get out those plumbing tools! Your family dishwasher uses 14 gallons of hot water per load to clean the dishes for family use. Statisticians estimate that 9000 barrels of oil each day, enough to heat 140,000 homes in winter, could be saved if each dishwasher user eliminates just one load a week. Load your dishwasher fully before turning it on. By eliminating one load a week, you not only save yourself time and money but also save oil for our country!

#### LIGHTING IN THE HOUSEHOLD

Lighting our homes consumes 16% of the household electricity. One 100-watt bulb burning for just five hours consumes the same amount of energy as opening 3600 cans with an electric can opener! By turning out those unnecessary lights and replacing one bulb in three with either a lower wattage bulb or a burned out bulb for safety's sake, electrical energy conservation can be as simple as American ingenuity.

## AIR-CONDITIONING IN THE HOUSEHOLD

Another sensible measure of home conservation regards the use of the air-conditioner. Air-conditioning accounts for one-half or more of our electric use during the cooling season. Remember that unvented dryers, uncovered boiling pots, unnecessary use of appliances all increase the room temperature, and so the air-conditioner must fight harder to cool the air. Drawing your living room draperies and those in other rooms against the streaming sunlight helps keep the room temperature cooler, as does lower wattage lighting. Maintaining those thermostats during the summer months at 78-80 degrees results in 2% less consumption of the total electrical consumption per year for the United States and could cut your family's summer fuel costs by as much as forty-seven per cent!

## OTHER CONSUMERS OF ELECTRICITY IN THE HOUSEHOLD

The home refrigerator and television set are other electrical appliances that use household electricity. Your family's food will be safely stored at 38-40 degrees in the refrigerator. Setting the refrigerator at cooler temperatures uses more energy than is necessary. Remember that the fewer times the refrigerator door is opened, the cooler the storage area stays. Color tube television sets annually consume an estimated average of 660 kilowatt-hours. Black-and-white tube television sets annually consume an estimated average of 350 kilowatt-hours. Watching one television set together rather than having more than one running for individual viewing will keep the family involved with each other plus saving on energy. When you are busy with household duties, stepping out of the house for a time, or at bed-time unplug the "instant-on" television set which continues to use energy even when the screen is dark.

Your everyday household duties are an important part of your life. The home electrical appliances help make your life easier, more efficient, and more enjoyable. Our seventy million American households use 20% of all the energy consumed in our nation. With 6% of the world's population, America uses one-third of the world's energy each year. Realizing that you are a part of the whole country's energy consumption is the beginning step for the United States' conservation of energy. We want to assure future generations that when the light switch is flipped on the lights of our country will burn brightly.

## ENERGY USE

The term "energy conservation" rings familiar. The United States, which consumes one-third of the energy used in the world every year, is running out of energy sources. Ninety-five per cent of our fuel is taken from nonrenewable sources. The United States "energy problem" is common knowledge. What is not commonly understood is how individual conservation efforts affect the overall situation. Energy conservation can begin in the households by the conservative use of electrical home energy. By following these and other common sense conservational measures, each household can save on the consumption of energy and also save on the household energy bill.

### HOT WATER HEATING IN THE HOUSEHOLD

Heating water takes 15% of the energy used in the household and 3% of all energy used in the United States. Turning on the hot water tap has become an almost subconscious use of energy. The drip of the faucet has become the rhythmic undercurrent of the household. A leak of one drop per second of hot water adds up to about 650 gallons per year. A leak that fills a cup in ten minutes uses 3280 gallons of heated water a year. Wasting such energy on leaky faucets is avoided by the simple effort of repairing the faucets. Another waste of heated water comes in filling the bathtub to the brim. A shower takes five gallons less water than a bath and thus saves energy. The average household dishwasher uses 14 gallons of hot water per load. Statisticians estimate that if each dishwasher user eliminates one load per week 9000 barrels of oil each day would be conserved. Loading the dishwasher fully each time before it is turned on would easily eliminate that one load each week per household. Setting the hot water heater at 140 degrees sufficiently heats the water for baths, the dishwasher, and cleaning clothes.

### LIGHTING IN THE HOUSEHOLD

Of the electricity used in the household, sixteen per cent is consumed by lighting. One 100-watt bulb burning for just five hours uses the equivalent amount of energy as opening 3600 cans with an electric can opener. Turn out those unnecessary lights, and replace one bulb in three with either a lower wattage bulb or a burned out bulb for safety's measure. Conservative home lighting saves energy and on energy bills.



## AIR-CONDITIONING IN THE HOUSEHOLD

Another sensible measure of energy conservation within the household regards the use of the air-conditioner. Air-conditioning can account for one-half or more of all your electric use during the cooling season. Remember that unvented dryers, uncovered boiling pots, unnecessary use of appliances all increase the room temperature, and so the air-conditioner must use more energy to cool the hotter air. Drawing the draperies against the sunlight and avoiding the overuse of high wattage lighting helps keep the room temperature cooler so that the air-conditioner will not have to work against more hot air. Maintaining the thermostats during the summer months at 78-80 degrees results in 2% less consumption of the total electricity consumption per year for the United States and could amount to as much as a 47% cut in summer fuel costs for a household. For each degree less than 78-80 degrees, five per cent more energy is used per degree in the household.

## OTHER CONSUMERS OF ELECTRICITY IN THE HOUSEHOLD

The refrigerator and television set are other electrical appliances that consume household energy. The recommended temperature for a refrigerator is between 38-40 degrees. Setting the refrigerator at cooler temperatures uses more energy than is necessary for safely storing food. Color tube television sets annually consume an estimated average of 660 kilowatt-hours. Black-and-white tube sets use an estimated average of 350 kilowatt-hours. The "instant-on" television sets use energy even when the screen is dark. When you are busy with household duties, out of the house, or at bed-time unplug the television set which continues to use electricity.

The seventy million households, which use twenty per cent of the total energy in the United States, can help cut the total American consumption of energy by following these and other simple saving efforts. With 40% of the oil imported and the energy sources within the United States running out, "energy conservation" must become a more meaningful way of life for each household consumer.

## Appendix E.

### ENERGY USE

#### United States and Household Energy Use

1. The United States consumes one third of the energy used in the world every year.
2. The United States has 6% of the world's population.
3. Oil, gas, and coal are the major sources of electricity and are nonrenewable sources of energy.
4. The United States imports 40% of the oil it uses.
5. Twenty per cent of all energy in the United States is used in the seventy million households.

#### Hot Water Heating in the Household

1. Heating water takes 15% of the energy used in the household and 3% of all energy used in the United States.
2. Setting the hot water heater at 140 degrees sufficiently heats water for bath and dishwashers.
3. A shower takes five gallons less hot water than a bath.
4. An average dishwasher uses 14 gallons of hot water per load.
5. A leak of one drop per second of hot water adds up to about 650 gallons a year.
6. A leak that fills a cup in ten minutes uses 3280 gallons of heated water a year.

#### Lighting in the Household

1. Lighting consumes 16% of all electricity used in the household.
2. One 100-watt bulb burning for five hours consumes the equivalent amount of energy as opening 3600 cans with an electric can opener.

#### Air-Conditioning in the Household

1. Air-conditioning accounts for one-half or more of the household's electric use during the cooling season.
2. Unvented dryers, uncovered boiling pots, unnecessary use of lights and appliances all increase the room temperature.
3. Thermostat maintenance of the air-conditioner for each degree less than 78-80 degrees results in the consumption of 5% more energy per degree for the household.

#### Other Consumers of Electricity in the Household

1. The recommended temperature for a refrigerator is between 38-40 degrees.
2. Color (tube) television sets annually consume an average estimated 660 kilowatt-hours.
3. Black and white (tube) television sets annually consume an average estimated 350 kilowatt-hours.
4. "Instant-on" television sets use energy when the screen is dark.